I. Application for a Permit for Scientific Research under the Marine Mammal Protection Act.

II. Date of Application: 23 May 2001

III. Applicant and Personnel:

A. Applicant:

Dr. Stephen B. Reilly
Director, IDCPA Research Program
Southwest Fisheries Science Center
National Marine Fisheries Service
P.O. Box 271
La Jolla, CA 92038
tel. (858) 546-7164, fax. (858) 546-5653
email. Steve.Reilly@noaa.gov

Principal Investigator:

Dr. Karin A. Forney
Protected Resources Division
Southwest Fisheries Science Center
National Marine Fisheries Service
110 Shaffer Road
Santa Cruz, CA 95060
tel. (831) 420-3908, fax. (831) 420-3977
email. Karin.Forney@noaa.gov

Primary Contact:

Meghan A. Donahue
Protected Resources Division
Southwest Fisheries Science Center
National Marine Fisheries Service
P.O. Box 271
La Jolla, CA 92038
tel. (858) 546-7064, fax. (858) 546-5653
email. Meghan.Donahue@noaa.gov

B. Qualifications and Experience: Curricula vitae are attached for the Applicant and Principle Investigator. Dr. Stephen Reilly has studied cetaceans, including the populations of dolphins involved in the tuna fishery in the Eastern Tropical Pacific Ocean, since the mid-1970s, authoring numerous peer-reviewed papers on the abundance, population dynamics, and ecology of these stocks. Since 1999, he has been in charge of the research program mandated by Congress in the International Dolphin Conservation Program Act; the research requested in this application is one component of this mandated program. Dr. Karin Forney has thirteen years of experience conducting research on the abundance, trends, ecology, status, and human-related impacts on populations of cetaceans in the eastern North Pacific Ocean. She has planned, coordinated, conducted and analyzed the results of aerial and shipboard marine mammal surveys since 1991, and published the results in peer-reviewed journals and technical reports. Since 1995, she has authored or co-authored annual Pacific Marine Mammal Stock Assessment

Reports required under the Marine Mammal Protection Act for up to 39 cetacean stocks off the U.S. West Coast and Hawaii.

IV. Description of Proposed Scientific Research

A. Abstract of Proposed Research Project

This research permit application covers the "experiment involving the repeated chasing and capturing of dolphins by means of intentional encirclement", mandated in the 1997 International Dolphin Conservation Program Act (IDCPA) (MMPA, Sec. 304(a)(3)(C)) as one component of stress studies on dolphins involved in the eastern tropical Pacific tuna purse seine fishery. The objective of the studies, as outlined in the law, is to "evaluate whether the intentional deployment on, or encirclement of, dolphins by purse-seine nets is having a significant adverse impact on any depleted dolphin stock." The requested studies will include several complementary research projects that address different ways in which chase and capture stress may manifest itself in individual dolphins involved in tuna purse seine operations (primarily spinner dolphins, *Stenella longirostris*, and pantropical spotted dolphins, *Stenella attenuata)*. Research techniques for evaluating stress will include a) analyses of single and repeat blood samples, b) molecular analyses of chronic stress from skin samples, c) measurement of dolphin surface and body temperatures to investigate heat stress, d) satellite tagging and tracking, and e) documentation of reproductive status and, if it occurs, cow/calf separation between successive chases. The requested research will involve the use of a NOAA research ship and a chartered tuna fishing vessel for two months during August-October 2001. During the course of the project, dolphins will be chased and encircled by the tuna purse seine vessel using standard fishing methodology. Within each set, individual dolphins will be tagged (with radio, satellite, thermal sensor or roto tags) and sampled (blood, biopsy, temperature, muscle pH, ultrasound, EKG). Care will be given to monitor the well-being of all animals handled, and to minimize risks to the dolphins. All dolphins will be released using the backdown procedure. On subsequent days, the animals with radio tags will be tracked by scientists aboard the NOAA vessel, and re-captured for sampling over the course of days to weeks. The results of the combined studies will provide broad data on the potential for fishery-caused stress.

B. Summary of Marine Mammals to be Taken, Imported, or Exported

B.1. Species names: The applicant requests the authority to take and import marine mammal parts as per the described research activities from the following target species and stocks:

Spinner dolphin, *Stenella longirostris orientalis*, Eastern Stock
Spinner dolphin, *Stenella longirostris*, 'Whitebelly' Stock
Spotted dolphin, *Stenella attenuata*, Northeastern Offshore Stock
Spotted dolphin, *Stenella attenuata graffmani*, Coastal Stock

The following species will not be the main targets for the proposed research, but may be sampled if they are caught incidentally:

Short-beaked common dolphin, *Delphinus, delphis*, Northern Stock
Long-beaked common dolphin, *Delphinus, capensis*
Spotted dolphin, *Stenella attenuata*, Southern/Western Stock
Spinner dolphin, *Stenella longirostris centroamericana,* Central American Stock

Striped dolphin, *Stenella coeruleoalba*
Fraser's dolphin, *Lagenodelphis hosei*
Pacific white-sided dolphin, *Lagenorhynchus obliquidens*
Bottlenose dolphin, *Tursiops truncatus*
Rough-toothed dolphin, *Steno bredanensis*
Risso's dolphin, *Grampus griseus*
Pilot whale, *Globicephala* spp.
Melon-headed whale, *Peponocephala electra*

B.2. Parts or specimen samples: Tissue samples (skin plugs or sloughed skin) and blood may be taken from any of the above-listed species that are captured. If the experiment occurs in the territorial waters of Mexico, Nicaragua, Costa Rica, Honduras or El Salvador, these parts will be imported under a CITES import permit. If the experiment occurs in international waters, the samples will be cleared in the U.S. under the SWFSC's CITES Introduction from the Sea Permit No.774223.

B.3. Status of affected stocks:
<u>*Depleted stocks:*</u> Three of the above dolphin stocks are considered depleted under the Marine Mammal Protection Act: the northeastern offshore spotted dolphin, the eastern spinner dolphin, and the coastal spotted dolphin. The population depletion was caused by high historical levels of dolphin mortality in tuna purse-seine nets, with an estimated 4.9 million dolphins killed during the fourteen year period 1959-1972 (Wade 1995). After passage of the Marine Mammal Protection Act in 1972, and the increased use of equipment designed to prevent dolphin deaths, mortality decreased gradually during the late 1970s and 1980s and the populations appeared stable after about 1975. Based on surveys conducted in 1986-90, Wade and Gerrodette (1993) estimated 730,900 northeastern offshore spotted dolphins, 631,800 eastern spinner dolphins, and 29,800 coastal spotted dolphins in the eastern tropical Pacific Ocean. As part of the IDCPA research program, more recent abundance estimates are now available for these three stocks in 1998-99, averaging 781,011 northeastern offshore spotted dolphins, 803,743 eastern spinner dolphins, and 96,687 coastal spotted dolphins (Gerrodette 1999; 2000). These 1998-99 estimates are not statistically different from those calculated for 1986-90.

<u>*Other stocks:*</u> The remaining stocks listed above are not considered depleted under the MMPA nor threatened or endangered under the ESA, and they are less frequently involved in tuna fishing operations. The most recent published abundance estimates (Wade and Gerrodette 1993, Gerrodette and Palacios 1996) are as follows: 1,019,300 'whitebelly' spinner dolphins, 476,300 short-beaked common dolphins (northern stock), 124,568 long-beaked common dolphins, 1,298,400 spotted dolphins (western/southern stock), 1,918,000 striped dolphins, 289,300 Fraser's dolphins, 243,500 bottlenose dolphins, 145,900 rough-toothed dolphins, 175,800 Risso's dolphins, 160,200 pilot whales, and 45,400 melon-headed whales. No abundance estimates are available for Pacific white-sided dolphins off Mexico or for spinner dolphins belonging to the Central American Stock; both stocks are rarely involved in fishing operations (Inter-American Tropical Tuna Commission, unpublished data).

C. Description of the Proposed Research Activity.

C.1. Duration of the project and location. The research project will be conducted during August-October 2001 on board a NOAA vessel and in cooperation with a chartered tuna purse seine vessel that has recently and actively been engaged in setting on dolphins. After allowing for required port calls and transit time, the number of working days in the study area is expected to be about 45-55 days. The study site will be dependent on weather and dolphin distributions, but will be within the core area for the target dolphin stocks, between the coast of Mexico and 120°W longitude and between 5°N and 25°N latitude.

C.2. Types of taking involved and estimate of numbers of animals that may be taken.
Table 1. Requested types of dolphins take (all species combined; most or all will be spotted or spinner dolphins).

Broken down by combination of take types for each individual										
	TOTAL	**Not handled**		**Restrained in water**	**Handled in raft and examined**					
		Set Only	Biopsy (Adult)	Skin Swab (Calf)	(Adults only)					
Number of dolphins:	24,000	21,360	1800	300	20	5	15	50	445	5
Set-related takes										
Chase		x	x	x						
Helicopter overflight		x	x	x						
Encirclement		x	x	x						
Photographed		x	x	x	x	x	x	x	x	x
Biopsy			x							
Calf skin swab				x						
Handling-related takes										
Blood sample					x	x	x	x	x	x
Saddle Package - Radio tag					x					
Saddle Package - Satellite tag						x				
Saddle Package - Thermal tag							x			
Roto-Radio tag								x		
Roto Tag									x	
Suction Cup Package - Thermal										x
Core temperature probe					x		x			x
Skin sample					x	x	x	x	x	x
Ultrasound					x	x	x	x	x	x
EKG					x	x	x	x	x	x
Accidental mortality	40 inclusive of all species									

a) Proposed takes: We are requesting authorization to take a total of up to 24,000 dolphins from any of the above-requested species by one or more of the following: chase, helicopter overflight,

encirclement, sample, examination, tag, and release (Table 1). Most or all of the encircled dolphins will be spotted or spinner dolphins, but other species may be caught incidentally and sampled. All take estimates are based on a maximum of 60 sets during the entire 2-month project, with up to nine dolphins handled per set, and an average school size of about 400 dolphins. The estimate of average dolphin school size is derived from IATTC observer program data for 1998-99 (1998: 392 dolphins per set; 1999: 465 dolphins per set). It is likely, however, that fewer dolphins will be captured during the proposed research, because a similarly designed capture/recapture study in 1992-93 encircled an average of only 100 dolphins/set during 29 sets made (S. Chivers, NMFS unpublished data).

b) An unspecified number of animals of all species may be incidentally harassed as a result of activities requested in a) above. No direct lethal takes are requested, but unintentional mortality is possible (see section *C.9. Lethal takes*)

C.3. Research in the wild. After arrival in the study area, schools of spinner dolphins and/or pantropical spotted dolphins will be located visually (using 25x binoculars) from the flying bridge of the research vessel or the crow's nest of the tuna vessel. When weather conditions are acceptable (Beaufort sea states 0-3, daylight; see Section C.9.), the tuna vessel will begin operations following standard fishing methods of chasing and encircling dolphins (National Research Council 1992). If a helicopter is available on board the tuna vessel, it will aid in locating the targeted or tagged dolphins within a school (at altitudes of 500-1000 ft over the dolphins to be captured). After capturing at least a part of the school, the net will be drawn closed at the bottom ('pursed') and retrieved as it is during normal fishing operations. Behavioral data, including standardized scans of dolphin behavioral states and focal animal sampling, will be collected from the crow's nest of the tuna vessel. Thermal photographs of dolphins will be taken from a small boat inside the net circle while the net is being retrieved, for about 20-40 minutes. The outboard engine on the small boat will be kept at slow idle and care will be taken to stay at a safe distance from the dolphins. This small boat will be removed from the net area before the net diameter becomes too small for safe operation around the dolphins, gear, and scientific personnel.

When the set coordinator (a biologist experienced with tuna purse seine operations) judges that it is safe, rafts and personnel will be deployed into the net for dolphin sampling and tagging. One to three deployed rafts will each contain one veterinarian or biologist skilled at collecting blood samples and attaching tags, and at least one assistant. An equal number of rafts will be deployed and partially flooded to hold the dolphins during sampling. At least three swimmers will be in the net to capture individual dolphins and assist in getting them into the sampling rafts. Handling time will be kept as brief as possible, and is estimated to take about 7-12 minutes per dolphin based on similar research conducted in 1992-93. The set coordinator will monitor operations from a separate raft, with particular attention to net stability and the state of dolphins.

All handled and sampled dolphins will be marked for future identification using either instrument packages, roto tags, or roto-radio tags. Instrument packages (including radio transmitters, time-depth recorders, thermal data-loggers, or satellite transmitters) will be attached to 1-3 animals per set, and roto-tags or roto-radio tags will be attached to any additional animals. Blood samples will be obtained from all tagged dolphins using standard sampling methods (see

below), and skin samples will be collected (via skin plug from tagging, biopsy, and/or skin swab). As time permits, a thermal probe will be used on a subset (up to 40) of the handled animals to measure core body temperature. An ultrasound will be performed on female dolphins to determine pregnancy status. A non-invasive EKG will be performed using a portable unit as time permits, to identify potential heart muscle damage.

The ability to select individual dolphins for handling in the net based on age, sex or reproductive state is limited, and it is expected that animals of all sex, age (excluding calves, but not excluding mothers) and reproductive classes may be tagged. Whenever possible, a high priority will be placed on tagging and recapturing females, because stress-related effects on reproduction (miscarriage, damage to foetus, separation from calves) are one major way that individual stress could translate into population-level effects. Any calves associated with a particular handled female will be allowed to remain as close as possible to the mother during tagging. Additionally, a skin sample will be obtained from the calf (using a scrubber, brillo pad or other minimally invasive skin sampling method designed to collect only the upper layers of skin), to allow DNA verification of relatedness between the calf and the presumed mother. This procedure will allow us to document whether cows and calves are separated during the chase and encirclement operations that occur during purse-seine fishing. Little data are available on this important source of potential fishery-caused mortality of dolphins (Archer et al. 2001). Fishing-related encirclement of individual ETP dolphins has been estimated to occur as often as once per week (Perkins and Edwards 1999). The study covered in this permit application is not expected to increase the number of cow/calf separations that may occur during purse-seine fishing operations, because in the absence of this study, the fishing vessel would have been engaged in normal dolphin-set fishing operations, causing similar separation events. The study will merely allow the detection of these events, if they happen. Without tagging females and genetically verifying relatedness of presumed mother/calf pairs, this important source of mortality cannot be documented properly.

The set coordinator will terminate all sampling operations when required to ensure safety of personnel and dolphins and proper functioning of the backdown procedure. As the backdown procedure is initiated, two scientific party members will be deployed at the backdown channel in a small boat to collect biopsy samples from animals as they leave the backdown channel using a biopsy pole (see below for specification details). These biopsy samples will provide additional molecular skin samples from animals known to have been encircled, for comparison to the historical samples analyzed at the SWFSC. Furthermore, the biopsy samples from animals that were not handled in the raft will provide a means of evaluating stress caused by handling compared to stress from only chase and encirclement.

Below are the details of equipment and protocol for the following types of sampling expected to occur during the chase-recapture experiment: (a) blood sampling, (b) skin sampling via biopsy and skin swab, (c) tagging, (d) deep body and surface temperature measurements, (e) other sampling.

(a) Blood sampling. While the dolphin is supported in the raft, blood samples will be drawn from a vessel on the ventral side of the fluke or peduncle using a 19 ga. 3/4" butterfly catheter. We plan to obtain a maximum of 100-200 ml per capture from each individual, not to exceed a cumulative total that is within established veterinary guidelines for the safe removal of blood from research animals (McGuill and Rowan 1989, Morton et al. 1993). These guidelines

recommend that, over the course of days to weeks, a maximum sample of 10ml blood per kg body weight may safely be taken, either as a single draw or in any number of smaller aliquots. Average weights are about 70kg for spotted dolphins, and 50kg for spinner dolphins, indicating that no more than 700 and 500ml, respectively, should be cumulatively removed from any individual during the study. A written record will be maintained of cumulative blood drawn from each handled dolphin to ensure that this maximum is not exceeded. Each handled and radio-tagged dolphin will be recaptured and sampled 1-4 times during the course of the study. If other dolphins remain associated with a radio-tagged animal and are incidentally recaptured, then these animals will also be handled and sampled 1-4 additional times. The blood samples will initially be placed in a cooler on board the small boats, and returned to the lab on board the research vessel as quickly as possible. There, hematological determinations will be performed using an electronic analyzer. Serum and plasma will be harvested after centrifugation and aliquoted into analysis-specific containers, as needed, and placed in cold storage using either dry ice or a -80°C freezer. Upon return to port, the samples will be sent out to veterinary medical and research laboratories for analysis. Blood components to be investigated include standard veterinary hematology and chemistry panels that will be indicative of overall animal health, exertion-related enzymes, stress hormones, and immunological indicators. Combined, these blood analyses will provide a synoptic evaluation of the animal's health, and will allow the documentation of any cumulative effects of chase-recapture stress, if it occurs during the course of repeated dolphin-set operations. Changes will be interpreted relative to the first sample for each animal, the time interval between samples, previously published values for these and other species of small odontocetes, established changes in stress and disease, and comparative samples from bottlenose dolphins recaptured as part of a separate, ongoing investigation in Sarasota, Florida.

Details of the blood analyses: Parameters will include white blood cells (Total and differential counts, including platelets), fibinogen, lymphocyte blastogenesis, cytokine analysis, red blood cells (total, HCT, HGB, MCV, MCH, MCHC), electrolytes (Na, K, Cl, Ca, P, Mg, Fe, TIBC, % saturation, anion gap, bicarbonate), metabolites (glucose, urea, uric acid, creatinine, billirubin (free and conjugated), triglycerides, cholesterol, total protein, albumin, globulin), enzymes (AP, GGT, LDH, AsAT, AlAT, CPK), hormones (cortisol, aldosterone, epinephrine, norepinephrine, T4, T3, fT4, rT3, ACTH, testosterone, estradiol, progesterone). An automated CBC analyzer will be used on board to perform duplicate analyses of each sample. A third determination will be conducted in the event of a deviation of more than 5% in the measured parameters. The performance of the automated analyzer will be monitored using control specimens supplied by the manufacturer. Hematocrits will be determined using both the automated analyzer and the conventional spun microhematocrit method for verification. Multiple smears will be made on board for later differential WBC counts (200 cells per slide, with some replicates included for validation). Microhematocrit tubes will be incubated on board for fibrinogen measurement. Blood samples in EDTA, heparin and serum separation tubes will be centrifuged to harvest plasma, serum and lymphocytes for appropriate analyses. All samples will be numbered but not identified as to animal or date to allow the inclusion of blind replicate samples in the laboratories where the analyses will be conducted. Internal standards will be inserted into automated runs, and the data from these will be examined for within-day and day-to-day variation. Serum chemistry and hormones will be analyzed at the Diagnostic Laboratory of Cornell University's veterinary college. This laboratory has performed similar

analyses on samples from bottlenose dolphins, and is prepared to run the same analyses on an upcoming study on bottlenose dolphins from Sarasota Bay. Hormone analyses are run in duplicate; discrepancies exceeding predetermined coefficients of variation for each specific assay will be resolved by running a third sample. Automated serum chemistry analyses will be performed as single determinations, with repeats only in the event of "outlier" results. Inter-laboratory validations of each analysis is considered to be unnecessary. Temperature control of the samples will be achieved by placing the blood samples on ice immediately after collection, manipulating the specimens in an air-conditioned laboratory on board, storing the samples at -80°C until return to port, and shipping specimens on dry ice to the destination laboratories.

(b) Skin/blubber samples. Skin samples will be collected for genetic and stress analyses by one of three methods: Tagging, skin swab, or biopsy. From dolphins that are tagged, the tissue plugs removed to insert the tag pins will be preserved for genetic analyses, and these dolphins will not be further biopsy sampled during that capture. If these individuals are re-captured and handled during subsequent sets, a 1mm handheld AcuDerm biopsy punch will be used to collect a repeat skin sample. Skin swabs, obtained by rubbing a mildly abrasive scrubber across the outer surface of the dolphin to collect only the upper layers, will be taken from calves that are associated with other sampled individuals if an appropriate opportunity arises. At the backdown channel of the purse seine net, as many dolphins as possible will be rapidly biopsied as they leave the net. We expect to sample from 1 to 30 dolphins, depending on the duration of the backdown and the number of dolphins encircled. A standard biopsy tip for use with small cetaceans (MMPA permit no. 774-1437) will be used: the tip cuts a 6mm skin plug and has a rubber stopper to prevent penetration deeper than the blubber. The tip will apply an antiseptic (Cetylcide II, a broad spectrum disinfectant with germicidal, fungicidal and virucidal properties) to disinfect the sample site at the time a sample is collected, and it will mark the animal with zinc-oxide for short-term future identification and re-sampling. Zinc-oxide is a harmless compound commonly used to prevent sunburn in both humans and stranded dolphins, and is expected to remain visible on the ETP dolphins for hours to days.

The skin and blubber tissue will be frozen or preserved in a tube containing saturated sodium chloride solution with 20% dimethylsulfide, as described in Amos and Hoelzel (1991). Upon the arrival of the tissue samples at the SWFSC, two types of analyses will be performed, 1) genetic analyses to determine relatedness of individuals and repeat biopsy samples from single individuals will be performed using standard, well-established procedures (Queller and Goodnight 1989), and 2) molecular analyses of stress responses in the skin samples, following methodology recently developed at the Southwest Fisheries Science Center specifically to investigate chronic stress in ETP dolphins (Southern and Dizon 1999). A publication describing the technique is being prepared currently. Historical skin specimens, from approximately 100 normal and stressed wild and captive dolphins and whales that experienced various diseases, starvation, hypoxia, panic, coastal pollution and potential tuna fishery-related stress, were analyzed using commercially available antibodies that target proteins involved in an epithelial molecular stress response. A group of over 35 stress-activated proteins (SAP), whose expression is increased in stressed dolphins and whales but not in the unstressed animals, has been identified in the historical samples. The test has been found to be unresponsive to short-term acute stress (the stress of capture and handling) in samples from captive animals, and is therefore a good indicator of chronic stress. A multi-target antibody cocktail is used to detect multiple

SAPs simultaneously, allowing for rapid 1-step visualization of the entire suite of SAPs. The SAP are structurally and functionally diverse molecules with recognized roles in oxidative stress response, apoptosis, cell growth and differentiation, immunological and neurological signaling and cell adhesion. The increased expression of SAP is widespread in the proliferating epithelial cells of the epidermis, and is retained for up to 70 days as the epidermal cells mature. The pattern of SAP induction seems conserved in different species, genders, ages and stressors, and is not sensitive to the biopsy collection site, as long as the sample includes the whole epithelial layer. The stress signatures of sampled animals, which have a known capture history during the course of this study, will be compared to a large number of historic samples obtained during fishery operations, from bowriding animals in areas of varying fishing intensity, and from captive stressed and non-stressed animals.

(c) Tagging and Tracking Methods. The instrument packages to be deployed during this study will be attached to the dolphins using methods that have been safely and successfully used on bottlenose dolphins in Florida (MMPA Permit Nos. 945, 655, 417) and on spotted dolphins in the eastern tropical Pacific (MMPA Permit No. 799). The deployments will range in duration from days to weeks and will therefore not cause any longterm adverse impacts on the dolphin stocks involved. Descriptions of the attachment methods to be used and the instrument packages to be deployed are as follows:

Attachment Methods: ***Saddle packages*** (i.e., a saddle to which tags and instruments are attached) will be secured to the dolphin's dorsal fin with ¼-inch delrin pins and magnesium nuts. Delrin pins will be used, because the pins have proven to be both safe and durable on dolphins. Prior to attachment, the dorsal fin will be cleaned with a topical antiseptic, and all equipment will be sterilized prior to use. Two attachment sites for the saddle will be probed with a narrow gauge needle to avoid major blood vessels, and the sites selected will be injected with a local anesthetic. Recent data indicate that the leading edge of the dorsal fin, particularly at the base of the fin, is one of the preferred attachment sites because of the thickness of the fin and the lack of major blood vessels (Scott et al., in review). A biopsy punch will be used to core the dorsal fin. The core will be just large enough to allow the 1/4" delrin pins to slide through, and magnesium nuts will be used to secure the tracking package and pins to the dorsal fin. The magnesium nuts, which dissolve in seawater, will ensure that the package is released within several weeks. It is likely, however, that the tag packages will be removed during the dolphin's final capture. ***Suction-cup attachments*** will be used to mount the instrument packages when only a few hours of data are required or when re-capture of the dolphin to recover the package is unlikely (e.g. at the end of the cruise or if weather conditions require moving to another area). The packages will be pressed onto the dorsal surface of the dolphin or on the dorsal fin. Gentle pressure on the sides of the saddle attaches the suction cups. A corrodible galvanic link secured on the outer surface of the front of the package holds the left and right halves of the saddle together. This link releases at a pre-determined time (2-48 hours), allowing the package to split apart from the front due to the force of the water, thereby releasing the suction cups and resulting in the shedding of the package. Over 30 deployments of such packages have been made without complications by scientists involved in the Sarasota Dolphin Research Program under previously issued NMFS MMPA permit (No. 945) for research on bottlenose dolphin. ***Roto tags*** (Scott et al. 1990) will be attached through the trailing edge of the dorsal fin using specially designed pliers. These roto-tags remain attached for weeks to months and have been used for decades as a dolphin

identification method (Scott et al. 1990). In this experiment, roto tags will provide information about group cohesion within the captured dolphin school, and will allow identification of previously captured and sampled dolphins. ***Roto-radio tags*** represent a modification of the simple roto-tag design to allow inclusion of a small (<20g) radio transmitter with a battery life of about 30 days. These tags are mounted via a single threaded delrin pin and corrodible nut for time release after several weeks. This type of tag represents the least invasive means of identifying and relocating sampled dolphins over short distances and time periods.

Instrument packages: The saddle packages and suction cup packages will each contain a combination of one or more of the instruments described below. Total package weight will be less than 500g for packages including thermal data-loggers, or less than 300g for all other packages. Maximum dimensions of the packages will be less than 28 x10 x 9 cm. The primary instrument to be used during this experiment will be a VHF radio tag to allow us to follow and repeatedly sample selected individual dolphins. Each radio tag deployed will be paired with a time-depth-velocity recorder (TDR), a satellite tag or a thermal data-logger to collect additional data about the dolphin's behavior and thermal condition. Details for each instrument are as follows: ***Radio tag*** will allow individual dolphins to be tracked from the research vessel and subsequently re-captured by the purse seine vessel. The 148 MHz radios tags are 7.6 cm x 1.3 cm with a 40 cm transmitting antenna, weigh approximately 30 g and are capable of withstanding water pressure at 500m depth. These are essentially the same tags that were successfully used during the 1992 and 1993 study of ETP spotted dolphin under MMPA permit No. 799. ***Time-depth-velocity-recorders*** are data loggers (Mk 8, Wildlife Computers) that records the time, depth, and velocity of the animal at specified time intervals as the animal moves through its environment. The tags are 7.4 cm long x 5.7 cm wide x 3 cm high and weigh approximately 70 g. They were successful deployed and recovered on ETP spotted dolphins during the 1992 and 1993 experiment. ***Satellite tags*** will collect data on dolphin movement by recording geographic position and on dive behavior by recording time-at-depth information. The tags weigh about 170g and are designed to transmit for weeks to months. ***Thermal data-loggers*** are designed to collect data on dolphin temperature and heat flux. The tag consists of several components including a Vatell Episensor disc and a data logger (Mk7, Wildlife Computers) that will record time, depth, water temperature, skin surface temperature, and heat flux continuously on free-ranging dolphins. The 2.5 x 2.5 cm heat flux disc is mounted on a small spring, to ensure constant contact between the disc and the fin while the animal swims. The heat flux disk is connected to an amplification circuit, and the amplified signals are sent to a data logger. Temperature is also recorded using a thermistor. The electronics are potted in epoxy and fitted into lateral pockets of the attachment package mounted on the dolphin's dorsal fin. Total dimensions are less than 28 x 10 x 9 cm, and total weight, including the saddle package and radio transmitter is less than 500g. These thermal tags have been previously developed and tested on bottlenose dolphins in Sarasota Bay, Florida (Pabst et al.1999), and are designed to release after approximately 48 hours.

(d) Deep body and surface temperature measurements. Deep body temperature is an important window into the physiological status of an animal. Like other mammals, dolphins can regulate their body temperature by controlling the flow of blood to the body surface (e.g. Scholander and Schevill 1955). The dolphin's uninsulated dorsal fin and flukes function as "thermal windows" across which excess body heat is dumped to the environment, and cooled blood is returned to the

body core. Dolphins possess a reproductive countercurrent heat exchanger (CCHE) that cools the uterus and, hence, the developing fetus in females (Rommel et al. 1993, Rommel et al. 1998) and the cryptic testes in males (Rommel et al. 1992). In this study, we will test the hypothesis that chase and capture causes dolphins to suffer thermal stress. We will collect three complementary data sets: (1) infrared thermographic images, (2) deep core body temperatures, and (3) thermal data loggers (see item *(c)* above) to record temperature. These measurements will permit us to compare the ETP dolphin temperatures to those we have collected from (a) captive animals before and after high exercise activity and (b) wild dolphins after a short chase and capture in Sarasota, Florida. Our recent captive animal work suggests that there is a latency period between the finish of exercise and the highest heat flux rates. Therefore, the most extreme thermal effects may occur after the animal has been released from the set. The thermal data-loggers offer an opportunity to capture that effect and to assess the health and thermal status of the animal upon its subsequent recapture.

Deep body temperatures will be measured using a standard veterinary probe, or a linear array of five copper-constantan thermocouples (Omega Teflon-coated 30 gauge wire) aligned on a flexible plastic tube, inserted through the rectum. The outside diameter of the probe is 5mm, and the length of the probe is 0.40 m. Insertion distance will be adjusted according to dolphin size. The array is covered with thin-walled heat shrink tubing. A tapered plug is fitted on the probe's anterior end and the entire assembly is heated to shrink to the wrap, thus making the probe weatherproof and electrically non-conductive. The probe is calibrated in a copper tube to ensure uniform thermal conditions. Measuring deep body temperatures with the array of thermocouples within the probe offers a safe means of assessing the effects of changes in peripheral blood flow on dolphin deep body temperatures. Experiments conducted on captive dolphins at the Naval Oceans Systems Center (NOSC), Hawaii Laboratory have been reviewed and accepted by the NOSC Animal Use Center. In these experiments, no perceivable differences in animals reactions to the use of this probe versus any of the standard veterinary probes used to monitor a single core temperature (Sweeney and Ridgway 1975). The probe will be inserted a conservative distance, estimated to be about 15-20 cm for *Stenella* dolphins. Larger dolphins will be targeted whenever possible.

Surface temperatures will be measured from thermal images obtained using a DTIS 500 infrared camera (Emerge Vision Systems) on dolphins swimming in the net, during handling, and after release. Captured digital images will be analyzed using Equine software (Emerge Vision System). The use of the DTIS 500 infrared camera is completely non-invasive.

(e) Other sampling. Additional biological samples and measurements will be obtained as time, operations and dolphin condition permit. Care will be taken to minimize impacts on individual dolphins, and these supplemental samples will only be obtained if the animal is not adversely reacting to the handling. To investigate pregnancy status in handled females, a rapid (30-60 second), non-invasive ultrasound scan will be performed using a Sonograder model (Renco) portable ultrasound unit. This unit can be used to rapidly establish pregnancy, but does not provide information on fetus stage or length. The A-mode ultrasound detects fluid-filled organs (i.e. an embryo in utero, distinguishable from the bladder), and has been evaluated by the project veterinarian for reliability in captive dolphins. The results will be used in conjunction with blood progesterone levels to ascertain pregnancy in the field. A portable electrocardiogram (EKG) unit (Biolog model made by Micromedical) will be used to monitor heart function and

damage to heart muscle if time permits. We will record lead II for a period of 30 seconds, which will give an accurate heart rate and allow the detection of any heart abnormalities detectable via EKG. The recording will temporarily stored in the EKG unit and will be subsequently downloaded into a computer for analysis.

(f) Sample size considerations: Sample sizes will largely be dependent on logistic constraints such as weather, dolphin densities and cohesion of dolphins within schools between recaptures. Because no similar previous data on live ETP dolphins subject to chase and encirclement are available, any number of samples for each of the research projects will provide new and unique insights into the potential for stress in ETP dolphins. The exact number of samples required to identify individual stress effects conclusively is dependent on the (unknown) magnitude of each effect. Large effects will be apparent with few samples, whereas more subtle or variable effects will require larger sample sizes. Interpretation of the results will be done in the context of actual sample sizes obtained and the effect sizes observed, and in comparison to other published data on stress in cetaceans and other mammals. Maximum expected sample sizes are those listed in Table 1; however, based on an assessment of likely conditions in the field, actual sample sizes may be about half of the requested numbers.

C.4. Removing a marine mammal from the wild. No marine mammals will be removed from the wild during these research activities.

C.5. Taking of marine mammal parts or specimens. Taking of marine mammal parts of specimen samples other than those described above will not occur.

C.6. Import/Export of marine mammal parts. Appropriate CITES import and export permits will be obtained as needed prior to the completion of the field work for samples collected within the EEZ of Mexico, Nicaragua, Costa Rica, Honduras or El Salvador. A CITES Introduction from the Sea Permit (No.774223) issued to the SWFSC will be used to import samples collected in international waters into the U.S.

C.7. Research on captive animals. Not applicable.

C.8. Background and review of research. The tuna industry has used the association between tuna and dolphins to fish in the eastern tropical Pacific for over five decades (National Research Council 1992. Three stocks of dolphins, eastern spinner dolphins, northeastern offshore spotted dolphins, and coastal spotted dolphins were depleted by high historical levels of dolphin mortality in tuna purse-seine nets, with an estimated 4.9 million dolphins killed during the fourteen year period 1959-1972 (Wade 1995). After passage of the Marine Mammal Protection Act in 1972, and the increased use of equipment designed to prevent dolphin deaths, mortality decreased gradually during the late 1970s, 1980s and 1990s. In 1995, the Declaration of Panama was negotiated between the United States and eleven other fishing nations to reduce mortality of dolphins to less than 5,000 per year. The International Dolphin Conservation Program Act (IDCPA), a 1997 Amendment to the Marine Mammal Protection Act, was created to implement the Declaration of Panama. While changes in the fishery have greatly reduced the observed mortality of dolphins, there continues to be concern that the fishing methods used are causing

stress to the dolphins involved and that such stress may be having a significant adverse impact on population recovery. As a result, the IDCPA requires that research consisting of population abundance surveys and "stress studies" be conducted by the National Marine Fisheries Service to determine whether the "intentional deployment on, or encirclement of, dolphins by purse-seine nets is having a significant adverse impact on any depleted dolphin stock".

One of the stress studies outlined in the IDCPA is an "experiment involving the repeated chasing and capturing of dolphins by means of intentional encirclement", which is the subject of this research permit application. Population-level conclusions about the potential for significant adverse impacts of fishery-induced stress will be based on the complete results of all studies mandated in the IDCPA, which include not only the chase/recapture experiment, but also population abundance surveys (Gerrodette 1999, 2000), a review of relevant stress-related research (Curry 1999), necropsy samples from dolphins killed in the commercial fishery, and a review of historical demographic and biological data from the affected dolphin stocks. The combined results from all five research components will be included in a final report to Congress evaluating potential significant adverse effects of the fishery on the involved dolphin stocks.

The goal of the chase/recapture experiment is to provide sound scientific data on physiological indicators of stress in chased and captured dolphins, and, if possible, to estimate a range of consequences for the individual dolphin's survival and reproduction. The planning of the chase-recapture experiment has been the subject of several workshops and consultations involving scientific experts (both federal and non-federal), representatives of non-governmental organizations, and representatives of the Marine Mammal Commission and the Inter-American Tropical Tuna Commission (see Curry and Edwards 1998, Sisson and Edwards 2000, Donahue et al. 2000). During those meetings, extensive discussion occurred regarding alternative experimental methods and modifications or additions to proposed methods to make the chase-recapture experiment as effective and appropriate as possible at addressing the requirements of the IDCPA.

The resulting design of the chase/recapture experiment consists of a suite of complementary research projects that separately address different ways in which chase/recapture stress may manifest itself. The individual research techniques, when combined, will provide data on the potential for fishery-caused stress in dolphins repeatedly chased and encircled using tuna purse seine methods. Additionally, some of the physiological data may allow estimation of quantitative or qualitative effects on survival and reproduction of individuals, which can be included in a population dynamics model to estimate a range of potential population-level effects. The individual research projects were selected to complement each others weaknesses and strengths wherever possible, while including only projects that are logistically compatible in the course of a single research program.

The blood analyses will provide repeated measures of stress indicators over a time course that includes multiple sets for single animals over a period of days or weeks. The objective is to measure the time course of responses of stress-related blood parameters in individual animals and to evaluate the potential for recovery between sets. A panel of experts in dolphin physiology and blood analyses was convened by the SWFSC on January 30-31, 2001 to determine the most effective suite of blood parameters to measure for the assessment of stress in ETP dolphins (Curry and Forney, in prep). Blood components to be investigated include standard veterinary hematology and chemistry panels that will be indicative of overall animal health, exertion-related enzymes, stress hormones, and immunological indicators, such as cytokines. Combined,

these blood analyses will provide a synoptic evaluation of the animal's health, and will allow the documentation of any cumulative effects of chase-recapture stress, if it occurs during the course of repeated dolphin-set operations. Changes will be interpreted relative to the first sample for each animal, the time interval between samples, reference values for these and other species of small odontocetes, established changes in stress and disease, and comparative samples from bottlenose dolphins recaptured as part of a separate, ongoing investigation in Sarasota, Florida. The blood samples will also provide indications of potential muscle damage, and the sex and relatedness of dolphins. Changes in hormone levels with repeated captures of pregnant females may allow detection of aborted pregnancies.

Skin samples provide an indication of sustained stress periods during the prior 70-day period, because stress-responsive proteins are deposited in the growing epithelial cells of the epidermis (Southern and Dizon 1999). A large collection of historical samples are being evaluated at the SWFSC as part of other IDCPA stress research. These samples can be linked to areas with a wide range of fishing effort, and samples from areas with little or no fishing effort represent an approximate control. The stress signatures of sampled animals, which have a known capture history during the course of this study, will be compared to historic samples obtained during fishery operations and from bowriding animals in areas of varying fishing intensity.

The thermal measurement/tagging component of the experiment will reveal the potential for hyperthermic stress in chased and recaptured dolphins. Thermal stress can cause maladaptive physiological changes or death. In pregnant females, damage can occur to the foetus leading to developmental problems or death; in males, hyperthermia can cause reproductive problems including sperm damage.

The satellite tagging and tracking component will provide a longer-term (weeks to months), vessel-independent record of movement of captured dolphins. A time-depth-recorder will be included in the attachment package to provide information on dive patterns and the frequency of fishery chases and encirclement of tagged dolphins. These tags will provide data in support of models estimating the frequency with which dolphins are chased and encircled as part of fishing operations (Perkins and Edwards 1999).

C. 9. Lethal Take.

No intentional lethal takes will occur, but unintentional mortality is possible. The purse seine methods to be used in this study can result in the accidental death of one or more dolphins, and there is a potential risk for pelagic dolphins to die after going into capture shock. Individual dolphins may die as a direct result of chase, encirclement (such as entangling in the net or becoming trapped under a canopy), or handling (such as capture shock). Under certain circumstances, which can involve unexpected changes in subsurface currents, winds, or gear malfunctions, the net may collapse while being retrieved and multiple dolphins may be trapped and die.

Dolphin mortality caused by the entire tuna purse seine fleet in 1998 averaged about 0.18 dolphins per set, resulting in a total mortality of 1,877 dolphins (IATTC 2000). During the 1992-93 studies of tuna/dolphin associations, 3 dolphins died as a result of a gear malfunction in one out of 23 project sets, yielding a rate of 0.13 dolphins per set. Based on these mortality rates, we estimate that during the course of this study (up to 60 sets), about 11 accidental dolphin deaths may occur as a result of the chase and encirclement operations. There is an additional,

unknown risk of handling, tagging and repeated capturing of the same individuals in this study. A maximum estimate of this potential mortality can be obtained from the 1992-93 studies. During the course of 19 handling events, one dolphin exhibited 'breath-holding' behavior, which may be indicative of capture stress, and was immediately released alive. If we assume that this response could have resulted in capture shock and death, then this rate of 0.053 adverse responses per handling event provides an upper bound for potential mortality caused by handling. With a maximum of 60 sets and up to nine dolphins handled per set, this could result in a potential handling mortality of up to 29 dolphins. Thus, the combined worst case mortality scenario for the two-month study would involve 40 individual dolphins (11 due to chase/encirclement, and 29 due to capture shock during handling) including any of the species listed in Item B.1.

Several precautions will be taken to reduce the above risk of death to chased, encircled and handled dolphins, and to prevent any accidental dolphin deaths. If dolphins should become trapped under a canopy, the swimmers inside the net will attempt to rescue dolphins (as personnel safety permits). To minimize the likelihood of net collapse, we plan to make sets only in calm weather conditions (Beaufort sea states 0-3) and during daylight hours ('sundown' sets have a higher risk of mortality). Furthermore, during our dolphin handling operations we will closely monitor net conditions, and speedboats will be available to tow portions of the net as needed to prevent collapse. These methods have been used successfully by the tuna purse seine fishery for many years. In the event of loss of net stability, all handling operations will be aborted and the dolphins will be released as quickly as possible. We will minimize the risk of capture shock by keeping the tagging and blood collection operation as short as possible (about 10 minutes per dolphin).

In conclusion, although we will take extreme care to prevent dolphin deaths during the course of this research, we cannot rule out the possibility of deaths. We therefore request authorization for up to 40 accidental lethal takes of any of the species listed in B.1. This dolphin mortality will be part of the IATTC Director's Reserve under the annual Dolphin Mortality Limits (DMLs) set for the fishery. It will replace any mortality that the chartered fishing vessel would have caused if it had been engaged in normal fishing operations. If any dolphins should die during this study, a necropsy will be performed in accordance with existing protocols for incidental kills in the ETP tuna purse seine fishery.

C.10. Research on endangered species. None of the species involved in this study are listed as endangered or threatened under the ESA. The eastern stock of spinner dolphins *(Stenella longirostris orientalis*) and the northeastern stock of offshore spotted dolphins (*Stenella attenuata*) have been the primary targets of "dolphin fishing." The eastern spinner dolphin and the northeastern offshore spotted dolphin were determined to be depleted under the MMPA most recently since 26 August 1993 (58 FR 45066) and 1 November 1993 (58 FR 58285), respectively. Because this study aims to determine if chase and encirclement during the course of purse seine fishing operations is having and adverse impact on ETP dolphin stocks and because these two depleted stocks are the dolphins primarily fished on, the proposed research cannot be conducted on alternative species or stocks.

D. Describe the anticipated effects of the proposed activity.

D. 1. Effects on individual animals. The potential for temporary or permanent adverse effects on individual animals is possible, but should be considered minimal based on past and current research conducted on dolphins that involves several of the same simultaneous sampling techniques, including handling, and tagging (e.g. Sarasota Dolphin Research Program, Wells et al. 1990). Temporary or permanent adverse impacts could occur from chase and encirclement during the operations by the purse seiner, which are the same as those conducted during normal tuna fishing operations during the course of about 10,000 sets per year (IATTC 2000). During standard fishing operations, ETP dolphins are caught an average of 8 times per year, and some are caught as frequently as once per week (Perkins and Edwards, 1999). The 30-60 sets requested for this study are a small fraction of the fishery total, and therefore the effects to the overall population will be relatively very small. Please see Section C.9. for a description of methods used to minimize the risk of unintentional mortality and adverse effects.

D. 2. Effects of incidental harassment. Apart from direct harassment that occurs during the purse seine fishing operations that will be employed, potential level B Harassment by Approach may occur incidental to dolphin school sighting operations that may be conducted from the research vessel. Only minor temporary effects are expected as a result of this harassment.

D. 3. Effects on stocks. This research seeks to evaluate the effects of fishery operations on the dolphin stocks of the ETP. No adverse effects on the population or stock level are expected to occur from the study itself, because the number of sets in this study is a fraction of those occurring annually during the course of fishing operations, and because the dolphin population sizes are large relative to the number of individuals that will be chased, encircled, and sampled.

D. 4. Stress, pain and suffering. There is a potential for the proposed research to cause stress, pain and suffering, above that caused by the chase and encirclement by the seiner. However, there are no feasible alternatives that satisfy the research mandates of the IDCPA law (see Curry and Edwards 1998 and Sisson and Edwards 2000). Several measures will be used to minimize the potential for stress, pain and suffering (see Section C.9.).

D. 5. Measures to minimize disturbance. In order to minimize disturbance to the dolphins being studied, we will keep handling time to a minimum (about 10 minutes) during capture and sampling operations, and we will release dolphins as quickly as possible if they show signs of handling stress. Whenever possible, we will attempt to capture only the subset of the dolphin school containing the target animals (those previously tagged), to minimize unnecessary disturbance of non-target animals. Calf skin samples will be collected using a minimally invasive technique. Calves will be allowed to remain close to the mother if the mother is handled, and if there are indications of danger to the calf, both will be released as quickly as is safely possible.

D. 6. National Environmental Policy Act considerations.
(a) New, innovative or controversial equipment or techniques? All of the sampling procedures described in this application have been used on dolphins before (alone and in combination) under previous MMPA permits (Nos. 945, 799, 774, 655, 417).

(b) Are these techniques likely to be adopted by other researchers? All of the sampling techniques requested are already being used by other researchers.

(c) Is the location of special importance to other marine mammals? The pelagic waters of the ETP do not have any special status. No adverse effects on other marine mammals in the study area are anticipated.

(d) Unique or unknown risks? The risk of dolphin death during purse seine fishery operations are well known and ongoing (National Research Council 1992). No unforeseen risks or long-term effects have been detected with the sampling and measurement techniques described herein, when they have been conducted on dolphins during the course of other research programs using the same capture and handling methodology.

(e) Public health or safety of humans affected? No.

(f) Significant cumulative effect? We do not expect any significant cumulative effects from this study. The effect of this 2-month study would be added to that of the existing fishery, but would be covered in the take allowed under the annual Dolphin Mortality Limits. In the absence of this study, the chartered purse seine vessel would be engaged in normal fishing operations involving the chase and capture of dolphins. The number of individuals to be handled and tagged (up to 540) is a very small fraction of the populations of these dolphin stocks (See Section B.3).

(g) Loss or destruction of significant scientific, cultural, or historic resources? None expected.

(h) Adverse effect on endangered or threatened populations or stocks or their habitat? No endangered or threatened stocks are involved in this research.

(i) Is the activity in violation of Federal, State or local laws for environmental protection? No.

E. Publication of results. The results of this study will first be presented in the peer-reviewed Final Report to Congress of the IDCPA Research Program, which will be submitted in 2002. Also, publication of specific aspects of the study will be published in peer-reviewed journals by scientists participating in the study.

F. Proposal and previous/other permits.

F.1. Formal Research Proposal. The research projects conducted by the Marine Mammal Division of the SWFSC fulfill the following objectives of the NOAA Strategic Plan: Reducing Bycatch (T1E), Assessing the status of protected species (T2A), Reducing marine mammal/fishery interactions (T2B), Implementing recovery/conservation plans (T2C), Taking a protective approach/prevent listings (T2D), Expanding ecosystems monitoring (T3C).

F.2. Cooperating Institutions.

Inter-American Tropical Tuna Commission
8604 La Jolla Shores Drive
La Jolla, CA 92037

Instituto National de Pesca
Pitágoras # 1320,
Col., Santa Cruz Atoyac,
Delegación Benito Juárez,
C.P. 03310, México, D.F.

F. 3. Previous permits. All reports required to date have been submitted for the MMPA permits that the Protected Resources Division of the SWFSC holds.

F. 4. Other permits. If the study will take place inside a foreign EEZ (Mexico, Nicaragua, Costa Rica, Honduras or El Salvador,), vessel clearance and research authorization will be obtained from the respective Government. The necessary CITES permits will also be obtained of the research takes place in the territorial waters of another country.

V. Foreign Applicants. Not Applicable.

VI. Certification and Signature.

"I hereby certify that the foregoing information is complete, true, and correct to the best of my knowledge and belief. I understand that this information is submitted for the purpose of obtaining a permit under one or more of the following statutes and the regulations promulgated thereunder, as indicated in Section I. of this application:

The Endangered Species Act of 1973 (16 U.S.C. 1531-1543) and regulations (50 CFR 222.23(b)); and/or

The Marine Mammal protection Act of 1972 (16 U.S.C. 1361-1407) and regulations (50 CFR Part 216); and/or

The Fur Seal Act of 1966 (16 U.S.C. 1151-1175).

I also understand that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or to penalties provided under the Endangered Species Act of 1973, the Marine Mammal Protection Act of 1972, or the Fur Seal Act of 1966, whichever are applicable."

_____
Signature of Applicant

Dr. Stephen B. Reilly.
Director, IDCPA Research Program
Southwest Fisheries Science Center
National Marine Fisheries Service

Literature Cited

Amos, B. and A. R. Hoelzel. 1991. Long-term preservation of whale skin for DNA analysis. Pages 99-103 in Genetic Ecology of Dolphins and Whales (ed. A.R. Hoelzel). Rep. Int., Whal. Commn. Special Issue 13.

Archer, F., T. Gerrodette, A. Dizon, K. Abella, and Š. Southern. 2001. Unobserved kill of nursing dolphin calves in a tuna purse-seine fishery. Marine Mammal Science 17(3) (in press).

Curry, B. 1999. Stress in Mammals: The potneital influence of fishery-induced stress on dolphins in the Eastern Tropical Pacific. NOAA Tech Memo NOAA-TM-NMFS-SWFSC-260. April 1999. 121 pp.

Curry, B. E. and E. F. Edwards. 1998. Investigation of the potential influence of fishery-induced stress on dolphins in the eastern tropical Pacific Ocean: Research planning. NOAA Technical Memorandum NMFS-SWFSC-254. 59pp.

Donahue, M.A., B. L. Taylor and S. B. Reilly. 2000. IDCPA Research Program chase-recapture experiment consultation, Southwest Fisheries Science Center, La Jolla, California - 25-26 April 2000. Administrative Report LJ–00-15, available from NMFS, SWFSC, PO Box 271, La Jolla, CA 92038. 21pp.

Gerrodette, T. and D. M. Palacios. 1996. Estimates of cetacean abundance in EEZ waters of the eastern tropical Pacific. Administrative Report LJ–96-10, available from NMFS, SWFSC, PO Box 271, La Jolla, CA 92038. 28pp.

IATTC. 2000. Annual Report 1998. La Jolla, California. 357 pp.

Mate, B. 1989. Satellite-monitored radio tracking as a method for studying cetacean movements and behavior. Rep. Int. Whal. Commn. 38:389-391.

McGuill M. W., and A. N. Rowan. 1989. Biological effects of blood loss implications for sampling volumes and techniques. ILAR News 315-20.

Morton D. B., D. Abbot, R. Barclay, B. S. Close, R. Ewbank, D. Gask, M. Heath, S. Mattic, T. Poole, J. Steamer. J. Southee, A. Thompson, B. Trussell, C. West, and M. Jennings. 1993. Removal of blood from laboratory animals and birds. First report of the BVA/FRAME/RSPCA/ UFAW joint working group on refinement. Laboratory Animals 27: 1-22.

National Research Council. 1992. Dolphins and the tuna industry. Committee on Reducing

Porpoise Mortality from Tuna Fishing, National Academy Press, Washington, DC.

Perkins, P. C. and E. F. Edwards. 1999. Capture rate as a function of school size in pantropical spotted dolphins, *Stenella attenuata*, in the eastern tropical Pacific Ocean. Fishery Bulletin: 97: 542-554.

Queller DC, Goodnight KF (1989) Estimating relatedness using genetic markers. *Evolution*, **43**, 258-275.

Scholander, P.F. and Schevill, W.E. 1955. Counter-current vascular heat exchange in the fins of whales. Journal of Applied Physiology. 8:279-282.

Scott, M.. D., R. S. Wells, A. B. Irvine and B. R. Mate. 1990. Tagging and marking studies on small cetaceans. Pages 489-514 in "The Bottlenose Dolphin" (eds. S. Leatherwood and R. R. Reeves). Academic Press, San Diego. 653pp.

Scott, M. D., A. J. Westgate, R. S. Wells, D. A. Pabst, W. A. McLellan, A. J. Read, F. I. Townsend, H. L. Rhinehart, M. B. Hanson and S. A. Rommel. (In review.) Dorsal fin morphology and attachment of radiotags to small cetaceans. Marine Mammal Science.

Sisson, J. and E. Edwards. 2000. Consultation between NMFS and non-governmental environmental organizations regarding a potential chase/recapture experiment: Meeting Report. NMFS Admin. Rep. LJ-00-04. 25pp.

Southern S. and A. Dizon. 1999. Molecular analysis of stress response in dolphins and whales: a new technique for monitoring environmental stress. Poster presented at the 13th Biennial Conference on the Biology of Marine Mammals, Nov 28-Dec 3, 1999, Wailea, Maui, Hawaii.

Stepto, N. K., D. T. Martin, K. E. Fallon, and J. A. Hawley. 2001 Metabolic demands of intense aerobic interval training in competitive cyclists. Med, Sci. Sports Exerc. 33: 303-310.

Sweeney, J.C. and S.H. Ridgway. 1975. Procedures for the clinical management of small cetaceans. J. Am. Vet. Med. Assoc. 167:540-545.

Wade, P.R. 1995. Revised estimates of dolphin kill in the eastern tropical Pacific, 1959-1972. Fishery Bulletin. 93:345-354.

Wade, P. R. and T. Gerrodette. 1993. Estimates of cetacean abundance and distribution in the eastern tropical Pacific. Rep. Int. Whal. Commn. 43:477-493.

Westgate, A. J, Pabst D. A.,McLellan, W. A., Williams, T. M., Wells, R. and Scott, M. 1999. An instrument to record heat-flux and surface body temperature from free-swimming dolphins. The 13th Biennial Conference on the Biology of Marine Mammals. nov 28-Dec 3, 1999, Maui, HI.

CURRICULUM VITAE

Stephen B. Reilly
Southwest Fisheries Science Center
National Marine Fisheries Service
P.O. Box 271
La Jolla, CA 92038
Tel. (858) 546-7164, fax.(858) 546-5653
email. Steve.Reilly@noaa.gov

EDUCATION:

University of California at Santa Barbara.
BA Environmental Biology June 1972.

California Polytechnic State University at San Luis Obispo.
MS Biological Sciences, December 1977. MS Thesis, "Distribution of pilot whales in the eastern tropical Pacific."

University of Washington, Seattle.
PhD Fisheries Biology, June 1981. PhD Thesis, "Population assessment and population dynamics of the California gray whale."

RECENT POSITIONS HELD:

Supervisory Fisheries Research Biologist, GS-0482-15, March 1999 - present.
Director, International Dolphin Conservation Program Act Research Program, SWFSC.

Supervisory Fisheries Research Biologist, GS/GM-0482-14, June 1, 1993 - March 1999
Leader, Ecology Program, Marine Mammal Division, SWFSC.

Supervisory Wildlife Research Biologist, GM-0486-15, February 2, 1993 - May 30, 1993.
Acting Chief, Marine Mammal Division, SWFSC.

Supervisory Fishery Biologist, GS/GM-0482-13/14, November 1986 - February 1993.
Leader, Ecology Program/Fishery-Dependent Assessment Program, Marine Mammal Division.

Operations Research Analyst, GS-1515-12, December 1981 - November 1986
Leader, ETP Dolphin Vital Rates/Dolphin Ecology Task

OTHER PROFESSIONAL EXPERIENCE:

International Whaling Commission's Scientific Committee: 1987 - present.

Scientific Committee Vice-Chairman 1992-1994, Scientific Committee Chairman 1994-1996, Convener, Standing Working Group on Environmental Concerns, 1997-1999.

US Global Ocean Ecosystem Program (GLOBEC),

Member, US Scientific Steering Group, 1996-2000.

National Science Foundation -

Review panel member for Biological Oceanography and Polar Programs

GULFCET I.

Member, External Advisory Committee. 1993-1995.

Marine Mammal Society,

Conservation and Science Advisory Committee, 1991-1992.

Science Panel to advise the Government of Mexico on plans to build a salt works at San Ignacio Lagoon, Baja California (a major calving area for gray whales). 1996-2000.

RESEARCH INTERESTS

Personal research interests focus on application of environmental information in the study of population and community ecology of marine vertebrates, especially cetaceans. Also develops and supervises marine mammal and protected species habitat research.

PROFESSIONAL SOCIETY MEMBERSHIPS

Marine Mammal Society, charter member.
Oceanography Society.
American Geophysical Union.

HONORS AND AWARDS

Bronze Medal, US Dept of Commerce, 1997. For work leading to the removal of gray whales from the Endangered Species List.

Research Award for Foreign Scientists, Japan Science Agency,1992.

PUBLICATIONS

JOURNAL PAPERS

Pitman, R.L., L.T. Ballance, S.B. Reilly & M. Force. 2001. Distribution, movements and population status of Craveri's murrelet: Implications for ecology and conservation. Condor. (in press).

Fiedler, P., S. Reilly, R. Hewitt, D. Demer, V. Philbrick, S. Smith, W. Armstrong, D. Croll, B. Tershy, and B. Mate.1998. Blue whale habitat and prey in the Channel Islands. Deep-Sea Research II: 45: 1781-1801.

Ballance, L.T., R.L. Pitman & S.B. Reilly.1997. Seabird community structure along a productivity gradient: importance of competition and energetic constraint. Ecology 78(5): 1502-1518.

Reilly, S.B. & P.C. Fiedler. 1994. Interannual variability of dolphin habitats in the eastern tropical Pacific. I: Research vessel surveys, 1986-1990. Fishery Bulletin, US 92: 434-450.

Fiedler, P.C. & S.B. Reilly. 1994. Interannual variability of dolphin habitats in the eastern tropical Pacific. II: Effects on abundances estimated from tuna vessel sightings, 1975-1990. Fishery Bulletin, US 92: 451-463.

Fiedler, P.C., F.P. Chavez, D.W. Behringer & S.B. Reilly. 1992. Physical and biological effects of Los Niños in the eastern tropical Pacific, 1986-1989. Deep-Sea Research 39(2): 199-219.

Reilly, S.B. 1991. We've got the blues in the eastern tropical Pacific. Whalewatcher 25(1): 7-8.

Reilly, S.B. 1990. Seasonal changes in distribution and habitat differences among dolphins in the eastern tropical Pacific. Mar. Ecol. Prog. Ser. 66(1-2): 1-11.

Reilly, S.B. & V.G. Thayer. 1990. Blue whale (*Balaenoptera musculus*) distribution in the eastern tropical Pacific. Mar. Mammal Sci. 6(4): 265-277.

Reilly, S.B. 1987. Reanalysis of rate of change in the California-Chukotka gray whale stock, 1967/68 - 1979/80. Rep. Int. Whal. Commn. 37: 347-349.

Reilly, S.B. & J. Barlow. 1986. Rates of increase in dolphin population size. Fish. Bull. 84(3): 527-533.

Reilly, S.B., D.W. Rice & A.A. Wolman. 1983. Population assessment of the gray whale, *Eschrichtius robustus*, from California shore censuses, 1967-1980. Fish. Bull. 81(2): 267-281.

Reilly, S.B., D.W. Rice & A.A. Wolman. 1980. Preliminary population estimate for the California gray whale based upon Monterey shore censuses, 1967/68 to 1978/79. Rep. int. Whal. Commn. 30: 359-368.

Barham, E.G., W. Taguchi & S.B. Reilly. 1977. Porpoise rescue methods in the eastern tropical Pacific tuna fishery, and the importance of tuna net mesh size. Mar. Fish. Rev. 32(6): 1-10.

BOOK CHAPTERS & PROCEEDINGS PAPERS

Bernard, H.J. & S.B. Reilly. 1999. The pilot whales, *Globicephala* sp., In: S. Ridgeway & R.J. Harrison (eds.), Handbook of Marine Mammals, Vol.6. Academic Press, pp. 245-279.

Reilly, S.B. 1992. Population biology and status of eastern Pacific gray whales: recent developments. In: McCullough, D.R. and R.H. Barrett (eds.), Wildlife 2001: Populations. Elsevier Science Publishers, Ltd., Essex, UK pp. 1062-1074.

Reilly, S.B. & S.H. Shane. 1986. The pilot whale. In: D. Haley (ed.), Marine mammals of eastern north Pacific and Arctic waters, 2nd edition. Pacific Search Press, Seattle, pp. 132-139.

Bernard, H.J., J.B. Hedgepeth & S.B. Reilly. 1985. Stomach contents of albacore, skipjack, and bonito caught off Southern California during Summer 1983. CalCOFI Rep. 26: 175-182.

Reilly, S.B. 1984. Observed and maximum rates of increase in gray whales, *Eschrichtius robustus*. In: W.F. Perrin, D.P. DeMaster & R.L. Brownell, Jr. (eds.), Reproduction in whales, dolphins and porpoises. Rep. Int. Whal. Commn., Spec. Issue 6: 389-399.

Reilly, S.B. 1984. Assessing gray whale abundance: a review. In: M.L. Jones, S.W. Swartz & J.S. Leatherwood (eds.), The gray whale. Academic Press, San Diego & New York, pp. 203-223.

Perrin, W.F. & S.B. Reilly. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. In: W.F. Perrin, D.P. DeMaster & R.L. Brownell, Jr. (eds.), Reproduction in whales, dolphins and porpoises. Rep. Int. Whal. Commn., Spec. Issue 6: 97-133.

Reilly, S.B. 1978. The pilot whale, In: D. Haley (ed.), Marine mammals of eastern north Pacific and Arctic waters. Pacific Search Press, Seattle. p 112-119.

NOTES, TECHNICAL PAPERS

Donahue, M.A., B.L. Taylor and S.B. Reilly. 2000. IDCPA research program chase-recapture experiment consultation, Southwest Fisheries Science Center, La Jolla, CA, 25-26 April 2000. Admin. Rept. LJ-00-15. 14p

Reilly, S.B. & P.C. Fiedler. 1990. Eastern tropical Pacific cetacean habitat studies: II. Species distributions and habitat variability. EOS, Trans. Amer. Geophys. Union 71(2): 69 (Abstract).

Fiedler, P.C., S.B. Reilly, D.W. Behringer & F.P. Chavez. 1990. Eastern tropical Pacific cetacean habitat studies: I. Environmental variability. EOS, Trans. Amer. Geophys. Union 71(2):92 (Abstract).

Fiedler, P.C., L.J. Lierheimer, S.B. Reilly, S.J. Sexton, R.J. Holt and D.P. DeMaster. 1990. Atlas of eastern tropical Pacific oceanographic variability and cetacean sightings, 1986-1989. NOAA Tech. Memo. NMFS-SWFC-144. 142p.

Lierheimer, L.J., P.C. Fiedler, S.B. Reilly, R.L. Pitman, LL Ballance, S.C. Beavers and D.W. Behringer. 1990. Report of ecosystem studies conducted during the 1989 eastern tropical Pacific dolphin survey on the research vessel *McArthur*. NOAA Tech. Rept. NMFS-SWFSC-140: 123pp.

[Twelve other tech. reports from ecosystem studies aboard MMD cruises, as above, in 1987-1996]

DeMaster, D.G. & S.B. Reilly. 1990. Monitoring the status of ETP dolphins. Rep. Int. Whal. Commn. 40: 127.

Reilly, S.B., J. Cooke, T. Gunnlaugsson, N.Oein and J. Siggurjohnsson. 1989. East Greenland - Iceland fin whale stcok trajectories with available CPUE series. Rep. Int. Whal. Commn. 39: 100-102.

Reilly, S.B., W. de la Marre, T. Miyashita and J. Cooke. 1989. Recommendations for the analysis of western North Pacific Bryde's whale sightings. Rep. Int. Whal. Commn. 39: 98.

Reilly, S.B. 1989. Report of a workshop on estimating mortality of dolphins in the eastern tropical Pacific US tuna fishery. NMFS-SWFC-Admin. Rept. LJ-89-12.

Zeh, J., S.B. Reilly & R. Sonntag. 1988. Bowhead whale population estimate and variance. Rep. Int. Whal. Commn. 38: 115-116.

Reilly, S. and M. Nerini. 1988. The relationships between lengths of captured bowhead whales, year of capture and village. Rep. Int. Whal. Commn. 38: 115.

Reilly, S.B. 1987. Tuna vessel observer data research plan for FY-1987 and beyond. NMFS-SWFC-Admin. Rept. LJ-87-11.

Reilly, S.B., A.C. Myrick Jr. & A.A. Hohn. 1983. Precision of age determination of northern offshore spotted dolphins. NOAA Tech. Memo. NMFS-SWFC-35:1-27.

CURRICULUM VITAE

KARIN A. FORNEY

National Marine Fisheries Service
Southwest Fisheries Science Center
Protected Resources Division
110 Shaffer Road
Sant Cruz, California 95060
Phone: 831-420-3908, FAX 831-420-3977
e-mail: Karin.Forney@noaa.gov

Born 11 August 1963 in Williamsport, Pennsylvania.

EDUCATION

1982 Abitur, Gymnasium Erding, Erding, Germany

1985 B.A., Cum Laude, in Ecology, Behavior and Evolution, University of California, San Diego.

1987 M.S. in Biology, University of California, San Diego. Thesis title: "The effects of population subdivision on single species survival: A laboratory model."

1997 Ph.D. in Oceanography, Scripps Institution of Oceanography, University of California, San Diego. Dissertation title: "Patterns of variability and environmental models of relative abundance for California cetaceans."

POSITIONS HELD

1990-present: Biologist (GS-9/11/12), NMFS, Southwest Fisheries Science Center.
Perform all aspects of research on population dynamics and status of marine mammal populations, with emphasis on abundance, distribution, status, human-related impacts, patterns of variability, and oceanographic correlates. Includes the design and implementation of research projects; extensive shipboard and aerial field work conducting surveys of North Pacific marine mammals; quantitative analyses using advanced statistical methods; and publication of results in peer-reviewed journals and technical reports.

1987-2000: Consultant, Center for Reproduction of Endangered Species, San Diego.
Provide computer consulting, conduct data analyses, and collaborate in research projects on wild and captive endangered species.

1987-90: Computer Programmer (GS-7), NMFS, Southwest Fisheries Science Center.
Provide computer programming and biological field support for research on dynamics and status of marine mammal populations.

1987-89: Computer Programmer/Behaviorist, San Diego Wild Animal Park.
Develop and implement computer applications for behavioral research on California condors.

1985-87: Teaching Assistant, Department of Biology, University of California, San Diego.
Serve as primary instructor and coordinator for Computer Programming for Biological Applications, including analysis of biological data and modeling. Assisted teaching advanced courses in Genetics, Evolution, and Systems Biology.

RESEARCH INTERESTS
Oceanographic correlates of the abundance and distribution of marine mammals.
Statistical techniques and sampling design in ecological research.
Fishery interactions with marine birds and mammals.
Computer applications in biological research.
Ecology and behavior of birds and mammals.

AWARDS AND HONORS
U.S. Department of Commerce, Bronze Medal, 1999. *For revealing a previously unrecognized threat to harbor porpoise, sea otters and seabirds in central California*.
Best Doctoral Student Presentation, World Marine Mammal Science Conference, 1998.
3rd Place Best Student Presentation, Meeting of the Society for Conservation Biology, 1997
Southwest Fisheries Science Center Awards
Staff Recognition Award, 1995.
Outstanding Performance Award, 1988, 1989, 1990, 1991, 1993, 1994, 1995, 1997.
Special Act and Service Award, 1995, 1998, 1999, 2000.
Sustained Superior Performance Award, 1989, 1994, 1995.
Take Pride in America Award, U.S. Department of the Interior, 1993.
Take Pride in California Award, State of California, 1993.
Partnerships in Education Community Friend Award, San Diego City Schools, 1993.
David Jay Gambee Memorial Award, University of California, San Diego, 1985.
B.A., Cum Laude, University of California, San Diego, 1985.

AFFILIATIONS
Society of Conservation Biology
Society for Marine Mammalogy

PEER-REVIEWED PUBLICATIONS
Forney, K. A., S. R. Benson and G. A. Cameron. 2001. Central California gillnet effort and bycatch of sensitive species, 1990-98. Pages 141-160, *In*: E. F. Melvin and J. K. Parrish (eds), "Seabird Bycatch: Trends, Roadblocks and Solutions", AK-SG-01-01, University of Alaska Sea Grant, Fairbanks, Alaska.

Zhu, X., D. G. Lindburg, W. Pan, K. A. Forney, and D. Wang. 2001. The reproductive strategy of giant pandas (Ailuropoda melanoleuca): infant growth and development and mother-infant relationships. London Journal of Zoology 253:141-155.

Hyrenbach, K. D., K. A. Forney and P. K. Dayton. 2000. Marine protected areas and ocean basin management. Aquatic Conservation: Marine and Freshwater Ecosystems 10: 437-458.

Forney, K. A. 2000. Environmental models of cetacean abundance: reducing uncertainty in population trends. Conservation Biology 14(5):1271-1286.

Forney, K. A. 1999. Trends in harbor porpoise abundance off central California 1986-95: evidence for interannual changes in distribution? Journal of Cetacean Research and Management 1:73-80.

Brownell, R. L, Jr, W. A. Walker and K. A. Forney. 1999. Pacific white-sided dolphin, Lagenorhynchus obliquidens Gill, 1865. Pages 57-84 In: Ridgway, S.H. and R. Harrison (eds.), Handbook of Marine Mammals, Volume 6. Academic Press, San Diego.

Carretta, J. V., K. A. Forney, and J. L. Laake. 1998. Abundance of southern California coastal bottlenose dolphins estimated from tandem aerial surveys. Marine Mammal Science 14:655-675.

Forney, K. A. and J. Barlow. 1998. Seasonal patterns in the abundance and distribution of California cetaceans, 1991-92. Marine Mammal Science 14:460-489.

Forney, K. A. 1997. Patterns of variability and environmental models of relative abundance for California cetaceans. Ph.D. dissertation, Scripps Institution of Oceanography, University of California, San Diego.

Forney, K. A. 1995. A decline in the abundance of harbor porpoise (Phocoena phocoena) in near-shore waters off California, 1986-93. Fishery Bulletin 93:741-748.

Forney, K. A., J. Barlow and J. V. Carretta. 1995. The abundance of cetaceans in California waters: Part II. Aerial surveys in winter and spring of 1991 and 1992. Fishery Bulletin 93:15-26.

Forney, K. A. and J. Barlow. 1993. Preliminary winter abundance estimates for cetaceans along the California coast based on a 1991 aerial survey. Rep. int. Whal. Commn. 43:407-415.

Barlow, J., L. Fleischer, K.A. Forney and O. Maravilla-Chavez. 1993. An experimental aerial survey for vaquita (Phocoena sinus) in the northern Gulf of California, Mexico. Marine Mammal Science 9:89-94.

Lindburg, D.G. and K.A. Forney. 1992. Long-term studies of captive lion-tailed macaques. Primate Report 32:133-142.

Forney, K.A., D.A. Hanan and J. Barlow. 1991. Detecting trends in harbor porpoise abundance from aerial surveys using analysis of covariance. Fishery Bulletin 89:367-377.

Forney, K.A., A. J. Leete and D. G. Lindburg. 1991. A bar code scoring system for behavioral research. American Journal of Primatology 23:127-135.

Forney, K. and M.E. Gilpin. 1989. Spatial structure and population extinction: A study with Drosophila flies. Conservation Biology 3: 45-51.

Forney, K.A. 1987. The effects of population subdivision on single species survival: A laboratory model. M.S. thesis, University of California, San Diego.

TECHNICAL REPORTS

Forney, K. A., J. Barlow, M. M. Muto, M. Lowry, J. Baker, G. Cameron, J. Mobley, C. Stinchcomb, and J. Carretta. 2000. U.S. Pacific Marine Mammal Stock Assessments: 2000. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-300. 276 pp.

Cameron, G.A. and K.A. Forney. 2000. Preliminary Estimates of Cetacean Mortality in California/Oregon Gillnet Fisheries for 1999. Paper SC/52/O24 presented to the International Whaling Commission, 2000 (unpublished). 12 p. Available from NMFS, Southwest Fisheries Science Center, P.O. Box 271, La Jolla, California, 92038, USA.

Mobley, J. R, Jr, S. Spitz, K. A. Forney, R. Grotefendt, and P. H. Forestell. 2000. Distribution and Abundance of Odontocete Species in Hawaiian Waters: Preliminary Results of 1993-98 Aerial Surveys. Southwest Fisheries Science Center Administrative Report LJ-00-14C. 26 pp.

Lowry, M. S. and K. A. Forney. (in prep). Abundance and distribution of California sea lions in central and northern California during 1998 and summer 1999. (To be submitted to Fishery Bulletin).

Forney, K. A., M. M. Muto, and J. Baker. 1999. U.S. Pacific Marine Mammal Stock Assessments: 1999. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-282. 62 pp.

Forney, K. A. 1999. The abundance of California harbor porpoise estimated from 1993-97 aerial line-transect surveys. Admin. Rep. LJ-99-02. Available from Southwest Fisheries Center, P.O. Box 271, La Jolla, CA 92038. 16pp.

Barlow, J., P. S. Hill, K. A. Forney, and D. P. DeMaster. 1998. U.S. Pacific Marine Mammal Stock Assessments: 1998. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS- SWFSC-250, 40 pp.

Barlow, J., K. Forney, A. Von Saunder, and J. Urban-Rodriguez. 1997. A report of cetacean acoustic detection and dive interval studies (CADDIS) conducted in the southern Gulf of California, 1995. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-SWFSC-250, 47 pp.

Barlow, J., K. A. Forney, P. S. Hill, R. L. Brownell, Jr., J. V. Carretta, D. P. DeMaster, F. Julian, M. S. Lowry, T. Ragen, and R. R. Reeves. 1997. U.S. Pacific Marine Mammal Stock Assessments: 1996. NOAA Technical Memorandum NMFS, NOAA-TM-NMFS-SWFSC-248. 223pp.

Forney, K. A. and Brownell, R. L., Jr. 1996. Preliminary report of the 1994 Aleutian Island Marine Mammal Survey. Working paper SC/48/O11 presented to the International Whaling Commission, June 1996, Aberdeen, Scotland.

Barlow, J., R. L. Brownell, Jr., D. P. DeMaster, K. A. Forney, M. S. Lowry, S. Osmek, T. J. Ragen, R. R. Reeves and R. J. Small. 1995. U.S. Pacific Stock Assessments. NOAA Technical Memorandum NMFS, NOAA-TM-NMFS-SWFSC-219. 162pp.

Carretta, J. V., K. A. Forney, and J. Barlow. 1995. Report of 1993-1994 marine mammal surveys conducted within the U.S. Navy Outer Sea Test Range off southern California. NOAA Technical Memorandum NMFS, NOAA-TM-NMFS-SWFSC-217. 90pp.

Forney, K. A. 1994. Recent information on the status of odontocetes in Californian waters. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-202. 87pp.

Barlow, J. and K. A. Forney. 1994. An assessment of the 1994 status of harbor porpoise in California in 1993. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-205. 17pp.

Carretta, J. V. and K. A. Forney. 1993. Report of the two aerial surveys for marine mammals in California coastal waters utilizing a NOAA Dehavilland Twin Otter aircraft, March 9-April 7, 1991 and February 8-April 8, 1992. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-185. 77pp.

Forney, K. A., D. A. Hanan and J. Barlow. 1989. Detecting trends in harbor porpoise abundance using aerial surveys: A preliminary report based on three years. Admin. Rep. LJ-89-20. Available from Southwest Fisheries Center, P.O. Box 271, La Jolla, CA 92038. 17pp.

Forney, K. 1988. Contour mapping and the calculation of areas between 10m depth contours along the coasts of California, Oregon and Washington. Admin. Rep. LJ-88-23. Available from Southwest Fisheries Center, P.O. Box 271, La Jolla, CA 92038. 18pp.

PROFESSIONAL PRESENTATIONS

Forney, K. A. 1999. Managing marine mammal bycatch in dynamic habitats: Lessons from a California gillnet fishery. Oral presentation at the Twelfth Biennial Conference on the Biology of Marine Mammals, Nov 29 - Dec 3, 1999, Maui, Hawaii.

Forney, K.A., S. R. Benson and G. A. Cameron 1999. Set gillnet effort and seabird by-catch in the Monterey Bay Region, California, 1990-97. Oral presentation at the Pacific Seabird Group Meeting, Semi-Ah-Moo, Washington, Feb 24-28, 1999.

Forney, K. A. 1998. Investigating the environmental component of trends in harbor porpoise abundance using generalized additive models. Oral presentation at the 1998 World Marine Mammal Science Conference, January 20-24, 1998, Monaco. (Best Doctoral Student Presentation Award)

Forney, K. A. 1997. Interpreting trends in cetacean abundance: Human-caused changes vs. natural variability. Oral presentation at the 1997 Meeting of the Society for Conservation Biology, June 6-10, 1997, Victoria, Canada. (3rd Place Best Student Presentation Award)

Forney, K. A., R. L. Brownell, Jr., and P.C. Fiedler. 1995. The distribution of marine mammals in along the Aleutian Islands in 1994 - Where have all the blue whales gone? Poster presented at the Eleventh Biennial Conference on the Biology of Marine Mammals, Dec 14-18, 1995, Orlando, Florida.

Carretta, J.V. and K.A. Forney. 1995. The abundance of California coastal bottlenose dolphins estimated from replicate aerial surveys. Poster presented at the Eleventh Biennial Conference on the Biology of Marine Mammals, Dec 14-18, 1995, Orlando, Florida.

Forney, K. A. and J. Barlow. 1993. Distribution and abundance of cetaceans in the California Current - a current and historical overview. Oral Presentation at the Tenth Biennial Conference on the Biology of Marine Mammals, Nov 11-15, 1993, Galveston, Texas.

Forney, K. A. and J. Barlow. 1991. Detecting trends in abundance of harbor porpoise, Phocoena phocoena, in central California. Oral Presentation at the Ninth Biennial Conference on the Biology of Marine Mammals, Dec 5 - 9, 1991, Chicago, Illinois.